ABSTRACT

Objective As lifelong learners, hospital pharmacists must continually improve their self-directed learning skills. Reasonable learning strategies have been proven to enhance self-directed learning (SDL) significantly. Therefore, this study aims to investigate the SDL strategies used by hospital pharmacists in depth to provide them with a reference for the development of their SDL skills.

Setting The study was conducted in three tertiary hospitals in Henan, China.

Design and participants This study employed a multicentre qualitative design and lasted 12 months. One-on-one interviews and focus group discussions were used to collect data. All interviews were transcribed verbatim, and the interview data were analysed using the thematic analysis method. Purposive sampling was used to select interviewees (n=17) from three tertiary hospitals in Henan province in central China.

Results After conducting data analysis, we summarised 12 learning strategies related to SDL, which were grouped into four themes: use of information resources, application of cognitive strategies, development of learning plans and use of learning platforms.

Conclusion The findings suggest that classic learning strategies, such as cognitive strategies and the development of learning plans, remain the cornerstones of hospital pharmacists’ SDL abilities, while contemporary advances in information technology and changes in learning concepts have enriched the learning resources and learning platforms that are available to hospital pharmacists and have confronted contemporary hospital pharmacists with certain challenges.

INTRODUCTION

Hospital pharmacists are lifelong learners. In China, a hospital pharmacist usually acquires a professional bachelor’s degree, which is generally obtained through 4 years of study at a comprehensive university or pharmacy college. Some pharmacy students choose to spend another 3 or 4 years obtaining a ‘master’s degree’ or a ‘doctoral degree’. However, the position of hospital pharmacists requires them to continuously update their medical knowledge and improve their practical skills.

As previously reported, the reasonable use of learning strategies is an efficient way to improve the effectiveness of independent learning. In order to become a qualified medical knowledge and improve their practical skills. The professional study in school in these years has only built a knowledge base; they must extract new information without explicit direction after beginning work. Critically, learning is self-directed in the absence of explicit direction. In the face of a vast array of learning resources and a learning environment that lacks explicit direction, self-directed learning (SDL) is a skill that they need to acquire in continuing education. However, studies have reported that medical professionals encounter many difficulties during the process of SDL. Similarly, a commentary article mentioned hospital pharmacists may encounter challenges when engaging in SDL. These difficulties pertain to time management, programme management and resource utilisation. However, there are few studies on learning strategies of Chinese hospital pharmacists, which prompted us to conduct an exploratory study for facilitating the theoretical research and promoting the application of SDL in China.
self-directed learner, a hospital pharmacist needs to develop a goal, outline a way of assessing the achievement of those goals, identify the structure and sequence of activities, plan a timeline to complete activities, identify resources to achieve each goal and obtain feedback on the plan. That is, hospital pharmacists as well as other medical professionals need to master learning strategies. This was reflected in similar studies. Zimmerman’s theoretical model of SDL included components of strategic planning, and the application of cognitive strategies was also mentioned. Other relevant research has focused on learning motivation. Recently, a study conducted by Wong et al showed that learning strategies can stimulate learning motivation and improve learning planning skills, thus enhancing learning efficiency and effectiveness. Therefore, understanding effective learning strategies is an important way of enhancing the SDL ability of hospital pharmacists.

Hospital pharmacists encounter difficulties in the process of developing and applying learning strategies, which mainly concentrate on the use and integration of learning resources and learning platforms, the understanding and application of cognitive strategies, and the development and implementation of learning plans. In modern society, information resources are exceptionally rich and learning platforms are becoming more and more diverse. A total of 986,012 new citations were published in MEDLINE in 2020, which raised a much larger number of indexed citations. Williamson et al reported that about 67% of the primary care physicians described the volume of literature as unmanageable. Meanwhile, some studies claimed that the overall quality of some learning resources on public platforms like YouTube or Tiktok was poor. Therefore, this current information explosion may lead to difficulties in selecting learning resources or may play a misleading role in their independent learning process. Besides, how to develop a proper learning plan is related to pharmacists’ ability to efficiently manage their learning time and exhibit an appropriate pace of learning, which constitutes the basis for ensuring their continuous SDL.

Although some studies have discussed ways in which professionals such as nursing professionals can solve problems regarding the use of information resources or improve their cognitive skills and planning, little is known regarding how hospital pharmacists select and apply effective learning strategies in the process of SDL. A deeper understanding of this topic can serve as a reference for other pharmacists who want to engage in SDL. Therefore, a qualitative study was conducted to explore the learning strategies that hospital pharmacists use when engaging in SDL. Based on a review of the previous literature as well as our practical experience, this study focuses on the application of learning resources and platforms, the application of cognitive strategies, and the development and implementation of learning plans by hospital pharmacists.

**METHODOLOGY**

**Design and setting**

We hope to explore the hands-on experiences of hospital pharmacists to identify the learning strategies that they usually use when learning in a self-directed manner. Therefore, the use of a qualitative study is appropriate for this study.

The study was conducted in three large tertiary hospitals in Henan province, which is located in central China and has a large population of approximately 100 million. The three hospitals are the First Affiliated Hospital of Zhengzhou University (with approximately 8500 beds and 360 pharmacists), Henan Provincial People’s Hospital (with approximately 5000 beds and 260 pharmacists) and Henan Cancer Hospital (with approximately 5000 beds and 150 pharmacists). These hospitals employ nearly 800 hospital pharmacists in total, thus providing a rich sample source for this study.

**Study population**

A purposeful sampling method was employed to select hospital pharmacists as interviewees from the sample hospitals, including dispensing pharmacists, clinical pharmacists and pharmacy department managers. The inclusion criteria for pharmacists as interviewees were as follows: (1) working as a full-time pharmacist for at least 3 years; (2) possessing at least a bachelor’s degree and (3) being willing to participate in the present study. When selecting interviewees, we fully considered the diversity of the sample in terms of age, gender, time of graduation, years spent working and type of work. Seventeen hospital pharmacists participated in our study. Among them, seven were enrolled from the First Affiliated Hospital of Zhengzhou University, six from the Henan Provincial People’s Hospital and four from the Henan Cancer Hospital. The basic information of all the participants is shown in Table 1.

**Data collection**

The data collection period lasted from August 2020 to July 2021. Semistructured interviews facilitate participants to share detailed accounts of experiences, interpretations and perspectives. Therefore, semistructured interviews were conducted on a participant-friendly basis. Since some medical professionals working on the front line felt anxious, the global COVID-19 pandemic did influence the process of selecting participants in the following ways: first, the interview process was forced to be conducted in two phases. The first phase lasted from August 2020 to December 2020, during which 11 study participants were included. The second phase lasted from May 2021 to July 2021, during which six study participants were included. To ensure homogeneity between the subjects in phase I and phase II, the inclusion criteria were the same for both phases. Second, the epidemic resulted in extended study duration. In order to ensure the validity of the interviews, all of our interviews were conducted in a face-to-face manner. Factors such as the epidemic prevention and
control policy significantly influenced the appropriate time for appointments with interviewers, resulting in a relatively long duration of the study. Previous related studies by our group generally lasted about 6 months. Third, due to the policy of epidemic isolation, we did not select interviewees from other provinces.

Prior to conducting the formal interviews via telephone, WeChat or face-to-face conversation, we communicated with interviewees regarding basic theoretical knowledge related to SDL and learning strategies. The purpose of the study was then explained, and an interview time and location were determined. After the interviewees signed a written informed consent form, interviews were arranged in a quiet and comfortable environment, usually in the pharmacy office or the clinical pharmacist’s office.

The most commonly used techniques for collecting data for a qualitative study are one-on-one interviews and focus groups. A one-on-one interview is an interactive process between the interviewer and interviewee, which helps to understand the interviewee’s feelings and thoughts in depth. Focus groups are characterised by exploring the interaction between research participants and reaching a consensus. Using a combination of one-on-one interviews and focus group discussions allows the researcher to provide an enhanced description of the phenomenon’s structure. Therefore, 13 hospital pharmacists (coded as P1–P13) participated in one-on-one interviews, and 4 hospital pharmacists (coded as G1–G4) participated in a focus group discussion. During the interview, if a topic had not appeared to have been sufficiently covered during an interview or the interview had raised new questions requiring further investigation, we sought new participants until data saturation was achieved, meaning that the discussions did not introduce anything new. All interviews were completed by two researchers, ZY and HL. ZY is responsible for asking questions and communicating with the participants. HL is mainly responsible for recording and supplementing questions. The research team developed an interview guide based on previous literature and the purpose of the study. As the study progressed, the research team continued to revise and refine the interview guide. The interview guide was available in the online supplemental material.

Data analysis
Thematic analysis is commonly used to assess participants’ perspectives and identify similarities and differences in responses, creating a rich description of the data. Therefore, the present study used thematic analysis to identify, analyse, organise, describe and report themes within the dataset.

The key steps of thematic analysis include acquainting data, initial coding, searching themes, reviewing themes, and defining and naming themes, as shown in figure 1. Within 24 hours of each interview, the audio recordings were transcribed verbatim by ZY and HL. In addition, the interviewers (ZY, HL) reviewed and checked the translation draft prior to data analysis. Subsequently, two researchers (ZY and HL) used NVivo V.12 software to independently extract open topics, creating initial codes and category drafts. ZY and HL recorded the characteristics and any meaningful points shown by the data during transcription for discussion and analysis. A consensus on the coding and understanding of the data was reached in the form of group meetings. At the same time, all data were sorted out with specific codes assigned. The complete codebook was then reviewed, searching for relationships and patterns to identify inductive themes. Under the guidance of a senior research expert (YZ), the research team compared and analysed all differences and established the final themes and subthemes. Finally, representative quotations were

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</table>

Table 1 Overview of demographic characteristics

Figure 1 The steps of thematic analysis.
selected to illustrate themes or subthemes. To improve validity, all participants were offered the opportunity to review the transcripts. This study followed the guidelines of the Consolidated Criteria for Reporting Qualitative Studies checklist (which is included in the online supplemental material 2).

Patient and public involvement
Patients and the public were not involved in this research initiative.

FINDINGS
Based on the data analysis, we identified a total of 12 learning strategies commonly used by hospital pharmacists engaging in SDL and grouped them into four themes, which are shown in figure 2.

Application of cognitive strategies
As one of the learning strategies, cognitive strategies are different methods and techniques for processing information, which can be considered to constitute strategies for information processing. Personal cognition refers to the information processing activity performed by individuals concerning the objective world. Personal cognition is important for learning or memorising. With regard to the application of cognitive strategies, hospital pharmacists mentioned summarising and reflection, memorisation and imagery, and the integration of theory and practice.

Summarising and reflection
Summarising and reflecting are important strategies in the process of SDL. Pharmacists cooperate in the process of learning in response to practical difficulties and grow closer to one another through mutual interactions.

Sharing with others by summarizing is a mutually beneficial relationship. In the process of sharing with others and reflecting, it is a process where you urge yourself to study. (P4)

In the process of sharing with others, it is actually a process of you urging you to learn. So I feel that they benefit from sharing this with them again, and then I myself am also benefiting. (P2)

Memorisation and imagery
Memorisation is a process of information processing and extraction, and some basic methods for memorisation are available; accordingly, this approach is an effective learning method that involves the use of memory rules to promote learning. Based on the content mentioned by the pharmacists interviewed, learning methods include repetition, comprehension, associative cognition/creation of nursery rhymes, relevance cognition/connection of single materials, and segmentation.

It’s about all the original materials in your brain. A single piece of material is not enough to deepen the memory. If you connect them together, then your cognition will be deeper. (P1)

The fact is that you can’t memorize all these paragraphs at one time, but you can memorize paragraph by paragraph and understand paragraph by paragraph. We like to draw lines and mark the key points. I think these can be summarized as what I just called cognitive strategies. (P2)
Integration of theory and practice

In simple terms, the integration of theory and practice means to apply what you have learnt. The purpose of all knowledge is to apply the learnt theoretical knowledge in practice. The process of combining theory and practice is equivalent to the process of knowledge transfer and transformation. In the process of SDL, practice can help strengthen and verify the theories one has learnt. Theory is derived from practice and in turn guided practice; the two elements complement each other. The strategies used by pharmacists in the process of SDL can be summarised as learning from practice, combining theory with practice and clinical thinking.

For pharmacists, if we have a question, we will go to study. After that, if you don’t put it into practice and you don’t summarize it by yourself, you may think that you have learned 100%. However, in the end, only you have learned only 10%. (G1)

So, I think it will be more profound; that is to say, in terms of the theoretical study, if there is no practical application, without your own summary and refinement after the study, what you have learned will always be a piece of information, and this information will eventually be forgotten by you. (G3)

Development and implementation of study plans

Making plans reduces the blindness and randomness of and enhances the controllability of studying. It also increases the sense of order and thus relieves the panic and pressure associated with learning. The process of implementing plans involves sensibly regulating and limiting arbitrary learning behaviours, which helps greatly with respect to developing good SDL habits. Therefore, the question of how to persevere when implementing study plans is the most central issue associated with this strategy, and it is also very important to the process of SDL in general.

Making plans

This process includes making plans and studying with a purpose in mind.

For example, I plan to finish it in two weeks... Then, you need to write down all the things you plan to do each day and divide them into different parts. (P2)

Then, we made a study plan. After that, in fact, it is quite like the teamwork that I just mentioned; we have an agreement that we will discuss what we have learned every Wednesday afternoon. (P7)

Setting goals

A goal is a level or standard that you want to achieve. Goals serve two purposes: first, they represent a basis for effort and second, they constitute the impetus or the motivation for continuous improvement. Setting goals, constantly adjusting them, learning with a purpose and completing plans in accordance with one’s goals are key steps in the SDL process.

There should definitely be a goal... Then, there may be various adjustments during this process. (G2)

First, you have to start with a goal. For example, we all have a learning task or a purpose that we want to achieve, and then we have to design some learning methods according to this purpose. (G4)

Implementing plans

The core of the implementation of plans is to arrange the time reasonably. The more reasonable the schedule is, the more time we have at our disposal. The factors regarding the reasonable arrangement and use of time noted by the interviewees included the reasonable arrangement of time, the use of fragmented time, extension of study time and the need to set aside flexible study time.

If we encounter some unexpected events, such as the schedule being disrupted, I might make up for it afterward, and sometimes I will work overtime to get this done. (G2)

But I think they are able to combine fragmentary time. (G3)

I’ll always be urging myself to review the plan I’ve been working on... And the fact is that I always get it done before the deadline, which means that I’ll finish many tasks before the deadline that I set. (P6)

Use of information resources

Information resources are the collection of various elements of information activity that are accumulated during the information activities of human society with a core focus on information. In the modern era of advanced information, the use of information resources is particularly important to the process of learning. In terms of the use of the information resources, the commonly used resources mentioned by the interviewed pharmacists include online courses, professional databases, professional forums, books and literature.

Online courses

Online courses transcend the limits of time and space with respect to the learning process, enabling both teachers and learners to overcome the restrictive conditions of time and space and enhancing the accessibility of high-quality learning resources. The interviewees mentioned the following information during the interviews:

Then I’ll go buy some online courses to study. (P4)

There are some good courses, and they are all online. I can take part in any course that I want to... When I know what my fellows are doing, I probably know the gap between us and whether I am doing a good job. (P2)

Professional medical databases

Professional databases, such as UpToDate and Medex, offer a full range of data and are updated quickly, which can provide a strong direction for clinical practice.
Some professional databases that our hospital has, Wanfang Data, CNKI, and a database from Manchester that they bought. (P5)

UpToDate... the mobile version of Micromedex, the memo and the collection function of WeChat. (P4)

Professional books and literature
Professional books are highly systematic and targeted and provide a quick way of becoming familiar with a certain field. In addition, professional books and literature are very credible and are the first choices for hospital pharmacists to acquire professional knowledge.

Through the textbook. To buy some books and to learn through them. (P5)
So, for me, er, I still trust professional literature more and feel they are more authoritative and reliable. (P4)

Use of learning platforms
The proper use of learning platforms can help hospital pharmacists maximise their learning resources.

Continuing education
After beginning work, hospital pharmacists lack opportunities for systematic and centralised learning. Continuing education as a visiting scholar offers a valuable learning opportunity for their careers, which can promote their basic knowledge and professional skills and stimulate their interest in SDL.

When I came to Shanghai, I studied for two months, eight weeks. In fact, I think I progressed greatly during those eight weeks... I think those eight weeks were eight weeks of my life where I made a lot of progress. (P2)
Then, the department I was studying in had a member of the Academy of Sciences. So you think, they must be very formal in their medication. I followed the doctor’s checkups and so on, and then I analyzed his medication, and I think that was a very progressive period in my life. (G1)

Professional forums
The most popular professional pharmaceutical forums in China gather many like-minded medical practitioners who often share their personal and professional views or discuss professional issues in those forums. These forums represented a common place that allowed the interviewed hospital pharmacists to conduct SDL.

Medication Assistant, Medlive... including Dingxiangyuan and UpToDate, they all have mobile versions and can be used anytime. (P7)
Like Dingxiangyuan, those are the forums that doctors often use. We also use Medlive as well as their application or website. (P2)

Social platforms
In an era in which computers, cell phones and the internet are very common, people use social networking platforms to engage in social interaction and communication in their professions. Online social platforms have become important new learning tools that are essential for people’s studies and lives. Social networking platforms aggregate users according to their relationships and interests, and it is easy to form a circle-based information community to facilitate people’s communication and learning. During the interviews, many pharmacists mentioned this learning strategy, including the use of video accounts, professional official accounts and question-and-answer sessions in WeChat groups.

I also like his video account, and I can acquire a lot of professional knowledge from this video account. It’s because I have met some people who have a stronger learning ability. (G4)
I feel like I have learned a lot through those official accounts… For example, an official account about critical care medicine…. You can keep updated with a lot of cutting-edge knowledge. (P3)

DISCUSSION
To the best of our knowledge, the present study is one of the first qualitative studies in Mainland China to investigate the learning strategies that are commonly used by hospital pharmacists. Compared with previous studies, this study paid more attention to the expectations and experiences of hospital pharmacists relating to their daily work. Simultaneously, we found that classic learning strategies such as cognitive strategies and learning plans remained the cornerstones of SDL ability. However, contemporary advances in information technology and changes in perceptions have both enriched learning resources and learning platforms for contemporary hospital pharmacists and entailed challenges for them.

According to previous studies, cognitive strategies are key components of learning strategies. The results of this study also showed that in the process of SDL, hospital pharmacists tended to use cognitive strategies such as summarising, memorisation and reflection. Summarising is a strategy used to manage large amounts of information by creating simple summaries. It was found that this strategy was very important when hospital pharmacists were faced with complex and diverse information, and their creativity could be enhanced by capturing keywords, extracting key points or sequencing events. Simultaneously, participants stated that this strategy improved the feedback associated with ‘learning’ and ‘teaching’ and promoted communication between hospital pharmacists and other learners or instructors, thus boosting the effectiveness of their learning. One of the most important cognitive strategies is memorisation. Memorisation refers to storing information in the brain and recalling it at some point in the future in the form of visual, auditory...
or tactile information. Participants from this study said that they have applied many effective memory methods, such as repetition, comprehension, associative cognition, connection of materials and segmentation, which could be good references for future research. In addition, the results showed that the SDL of hospital pharmacists was mainly based on daily work practice. Therefore, the combination of theory and practice within a learning strategy is particularly important. Interviewees in this study mentioned that during the learning process, practice can reinforce and verify theoretical knowledge, and theoretical knowledge can guide practice. Similarly, a national analysis showed that physicians required training in educational approaches promoting SDL and they were more likely to improve metacognitive skills.

The second category found by this study is the development and implementation of learning plans, which includes three stages: making plans, setting goals and implementing plans. According to recently published models and scales of SDL, learning plans consist mainly of establishing learning goals, setting the priorities of learning, being able to follow plans of learning, and arranging and controlling learning time, which is consistent with the results of our study. With respect to the three stages included in this strategy, making learning plans can reduce the randomness of learning, setting goals can enhance the controllability of learning time and implementing plans can serve as a core factor for guaranteeing the implementation of SDL. One study conducted by Kastenmeier et al. found that supervising medical students to develop and implement personalised learning plans significantly improved their SDL and enhanced their educational outcomes. In an earlier study, Majumdar emphasised the importance of making learning plans for nurses in the process of SDL and illustrated in detail how the creation of learning plans enhances SDL ability in terms of learning objectives, learning resources and evaluations of effectiveness. The results of this study demonstrate that hospital pharmacists can achieve more efficient SDL by developing a learning plan.

Information resources refer to the collection of various elements that are accumulated during the information activities of human society. As science and technology progress, contemporary information resources are becoming very rich, and hospital pharmacists are required to choose rationally and use these resources efficiently. Our research found that hospital pharmacists usually used both traditional and new information resources, which was consistent with the results of a survey. It was reported that hospital pharmacists in Greece could be further supported as efficient providers through traditional libraries in public hospitals and information services from the internet. What is more, people are aware of the potential for misinformation on websites, and they mainly trust high-quality sites run by health authorities. Traditional professional books and literature are highly systematic and targeted; however, a defect in traditional professional resources lies in the fact that updates to these resources can be delayed as well as their excessive difficulty and specialisation. Compared with traditional information resources, new information resources are abundant, rapidly updated and easily accessible and are preferred by many young hospital pharmacists. Due to the widespread use of portable electronic devices, the internet has become the most common new learning tool used by hospital pharmacists. In addition, social networking platforms aggregate users according to their relationships and interests, and it is easy to form a circle-based information community to facilitate pharmacists’ communication and learning. Therefore, education administrators should pay more attention to the integration of online learning resources to guide hospital pharmacists to use them correctly and efficiently.

The use of learning platforms is probably one of the most easily overlooked elements of this process. At present, learning platforms can be divided into two categories: online learning platforms and offline learning platforms. In our study, participants noted that offline learning platforms not only provided hospital pharmacists with systematic and centralised learning opportunities, but also promoted their SDL ability. In the last few decades, online learning platforms have become an increasingly popular and important tool for medical and pharmacy education. Participants stated that they prefer online social platforms such as official WeChat accounts and WeChat groups, or online professional forums such as UpToDate and Dingxiangyuan (a medical internet forum in China) because they were easy to use. Some participants from this study emphasised the advantages of online learning platforms, which were consistent with previous studies. First, online learning platforms can overcome the barriers of distance to provide educational opportunities in remote areas. In addition, learning resources can be provided to isolated learners during an epidemic such as COVID-19. Second, the learning materials could be easily spread and updated. Third, learners were relatively free to choose the time and place of studying. Fourth, communication devices make real-time communication more convenient between learners and teachers. Based on the robustness of the traditional approaches and the convenience of the online models, managers should find ways to play to the strengths of each other.

CONCLUSION

This study used a descriptive, qualitative research approach to explicate the use of SDL strategies among hospital pharmacists. Traditional research on SDL ability provided the theoretical framework for this study and led to several interesting findings for our research team. Traditional learning strategies, such as cognitive strategies and plan-making, continue to be regarded as important parts of SDL, while contemporary learning resources and learning platforms present new opportunities as well as...
new challenges for hospital pharmacists who desire to engage in SDL.

Acknowledgements The authors acknowledge the support of all the interviewees who participated in the study.

Contributors XY, HL, and ZY designed the study and conducted the interviews. LW, YT, YZ and ZY analysed the data. ZY and XY wrote the manuscript. HF, XZ, JL and SD revised and reviewed the manuscript. ZY was particularly involved in the drafting, revising of the different versions of the manuscript and final approval of the version to be published. ZY is responsible for the overall content as the guarantor.

Funding The authors have not declared a specific grant for this research from any funding agency in the public, commercial or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Obtained.

Ethics approval This study involves human participants and ethical approval for the study was provided by the Ethics Committee at the First Affiliated Hospital of Zhengzhou University (KY-2020-050). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request.

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